Trends in child growth in the population covered by Plan Nacer and Programa Sumar between 2005 and 2013, in Argentina

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Based on: Nuñez, P. A.; Fernández-Slezak, D.; Farall, A.; Szretter, M.E.; Salomón, O.D. Valeggia, C.R. (2016). Impact of Universal Health Coverage on Child Growth and Nutrition in Argentina. *American Journal of Public Health*. 106 (4), 720-726

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To estimate trends of undernutrition (stunting and underweight) among children younger than 5 years covered by the universal health coverage programs.

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Method.

Through a statistical model.

Plan Nacer

Plan Nacer

- aimed to improve health status of uninsured children and pregnant women in situations of vulnerability
- directed resources to the public health care system to incentivize the provision of health services to beneficiaries
- covered pregnant women and up to 45 days after birth, and children up to age 6 years
- Implemented in two phases.
 - (in 2005) in 9 provinces in the northern regions of Argentina
 - (in 2007) expanded to cover the rest of the country

Programa Sumar

- follow-up program
- launched in 2012 and extended health-care coverage to 5.7 million children and adolescents (0-19 years) and 3.8 million women up to 64 years
- Both programs focus on 14 specific indicators of
 - pregnancy (detection and controls)
 - neonatal care
 - immunization
 - anthropometric checkups for children

Data available

Data for each record:

- anonymous identifier for each individual,
- health center (geographical source),
- the rural versus urban area of the health center,

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- anonymous identifier for each individual,
- health center (geographical source),
- the rural versus urban area of the health center,
- birth date
- visit date
- age (in days)
- gender
- weight (in kg)
- height (in cm)

Data Processing

During the 9-year period, Plan Nacer and Programa Sumar collected

- more than 13 million records
- 6386 health centers

Data clean-up

- we removed approximately 13 % of the records with missing or biologically implausible data
- computed z-scores according to World Health Organization 2007 standards tables, at individual-level

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Z-scores: HAZ and WAZ

Computed height for age z-score (HAZ) and weight for age z-score (WAZ) for children younger than 5 years covered by the programs, at each health control.

Definition (stunting and severe stunting)

A child is said to be **stunted** or **severe stunted** if his/her HAZ falls below -2 standard deviations or -3 standard deviations of zero, respectively.

stunting: "retraso en el crecimiento"



Prevalence of Stunting

Definition (prevalence of stunting and severe stunting)

We define the **prevalence of stunting** and **prevalence of severe stunting** as the proportion of stunted (or severe stunted) children in a population, respectively.

Likewise for underweight and severe underweight (for WAZ).

Flowchart of the data source



Summarize the global behavior of the prevalence

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Avoid potential bias effects in the analysis

That results from imbalanced interactions of the variables (observational study)

Example (1)

The distribution of ages of the children included in the study is not homogeneous: during the first years of the programs [2005 - 2006] younger than average children were included

Warning! Stunting and underweight are related to age

Example (2)

Different health centers (within departments and provinces) were enrolled in the study at different times, having heterogeneous exposure during the overall period.

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Different number of repeated measurement of the same child.

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Example (3)

Different number of repeated measurement of the same child.

Warning! More measurements could be associated with stunting and underweight.



$$P\left(\begin{array}{cc} \text{stunted at certain} & \begin{array}{c} time, \\ age, \\ rural, \\ sex \end{array}\right) = \beta_0 + \beta_1 time + \beta_2 (time)^2 \\ + \gamma_1 age + \gamma_2 (age)^2 + \gamma_3 (age)^3 \\ + \gamma_4 (age)^4 + \gamma_5 (age)^5 + \gamma_6 (age)^6 \\ + \beta_3 rural + \beta_4 sex \end{array}\right)$$

where, all $\beta's$ and $\gamma's$ are constants to be determined (estimated) by the data,

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where, all $\beta's$ and $\gamma's$ are constants to be determined (estimated) by the data, rural = 1 if is computed for a health center in a rural zone, 0 if not sex = 1 for a girl, and zero otherwise



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Mixed effect model: the random effect b_i takes into

account the correlation among observations (along time) for the same child.

Results

Curves depict estimated prevalence of stunting and severe stunting with the model for the whole population (A) and then conditioning to the mean (observed) values of gender, urban vs rural residence, and age. Circles represent empirical proportions, with the total area proportional to the number of records in the year.



Results

Curves depict estimated prevalence of stunting for age with the model for the whole population (left) and the observed ones (to the right), for different years. On the bottom, the same for underweight.



Results

- The prevalence of stunting decreased from 20.6 % to 11.3 %, between 2005 and 2013, nationwide
- Comparable results for each region

When we compare two childs with all other characteristics being equal.

- Prevalence of stunting for girls is 2.8 lower than for boys
- Rural inhabitants have a 2.6 higher probability of being stunted than urban ones